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## PRODUCTION OF LENS FOR EYES

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### Abstract

**PURPOSE:** To improve the quality of a lens material for eyes essentially consisting of a polyorganosiloxane and monomer having a silylated hydroxyl group by desilylating a molding obtd. by copolymn. in a casting mold made of a synthetic resin to form said lens material.

**CONSTITUTION:** The affinity of the casting mold having the hydrophobic surface made of the synthetic resin and the monomer which protects the hydroxyl group with the hydrophobic silyl group having affinity to the hydrophobic surface of said casting mold is good according to the above-mentioned production process; therefore, the copolymn. is executed while the hydrophobic silyl group of the monomer is held in proximity to the casting mold surface and the copolymer molding in the surface of which said hydrophobic silyl group exists much is obtd. The hydroxyl group is formed on the surface of the molding and the lens for eyes, the surface of which is hydrophilic and has good wettability with water is obtd., if such molding is desilylated by subjecting the same to a hydrolytic treatment. There is no possibility of the deterioration in the surface hydrophilicity by wear, etc., during use with the lens for eyes obtd. in the above- mentioned manner and the hydrophilicity stable for a long period of time is obtd.

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PRIOR ART

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[Description of the Prior Art]

In recent years, the material of a silicone system is mainly used for a contact lens and a flexible intraocular lens material with good oxygen permeability. However, generally the material of a silicone system was unsuitable as a lens material to which \*\*\*\* contacts a hydrophobic property to a living body (eye organization) directly if especially the front face remains water repellence as it is for a \*\*\*\* reason.

Then, the proposal of various improvement proposals, such as giving an electrodischarge treatment to the material of the aforementioned silicone system, in order to make a hydrophilic property give the front face, or carrying out copolymerization of the monomer of a silicone system and the monomer of a hydrophilic property, is made.

However, when surface hydrophilicity-ization gave by the above electrodischarge treatments, while using it, the problem that a hydrophilic property fell was. Moreover, when copolymerization of the monomer of a silicone system and the monomer of a hydrophilic property was carried out, the compatibility of the monomer of a silicone system and the monomer of a hydrophilic property was bad, and the monomer with the strong hydrophobic property of the amount of macromolecules like especially a polyorganosiloxane had the problem that it was very difficult to mix the hydrophilic monomer and homogeneity of only the considerable amount which gives sufficient hydrophilic property for the lens for eyes obtained. If a polymerization is carried out with mixture [ uneven ], it can deal only in an opaque copolymer and cannot be used as a lens for eyes. Although the method of introducing a hydrophilic radical into the monomer of a silicone system, and carrying out a polymerization to other monomers is proposed in order to solve the above problems, the hydrophobic property of a material has come [ then, ] to be improved fundamentally.

Then, as already indicated by JP,61-138613,A, this invention persons In case copolymerization of the polyorganosiloxane which has a polymerization nature machine and a hydrophilic radical, and other monomers is carried out to the same molecule side chain, the monomer which protected the hydroxyl group of the hydrophilic monomer which has a hydroxyl group with the trimethylsilyl machine is used. The compatibility of the polyorganosiloxane and the hydrophilic monomer which have a polymerization nature machine and a hydrophilic radical is improved and copolymerized in the same molecule side chain, and \*\* silanizing (hydrolysis processing) is given to after an appropriate time. Although it has the "sea-bird" structure of a hydrophobic domain and a hydrophilic domain on the micro target obtained, the uniform and transparent charge of oxygen permeability elasticity contact lens material is proposed on the macro target.

On the other hand, the material which makes a polyorganosiloxane a subject is usually considered to be elasticity, and to be a manufacture means with the most effective forming method by mold, since it is not difficult or processible by the usual cutting method in ordinary temperature (room temperature).

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EFFECT OF THE INVENTION

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[Effect of the Invention]

According to the manufacture method of the lens for eyes of this invention, the lens front face can present a hydrophilic property, and it can deal in the good lens for eyes of water wettability. And since a hydrophilic portion exists until the obtained lens for eyes reaches the interior, there is no concern of hydrophilic degradation of a lens front face, and it can maintain the hydrophilic property stabilized over the long period of time. Moreover, while the obtained lens for eyes has good oxygen permeability and a mechanical strength is good, it excels in flexibility.

Since both a vertical-mold front face and a moldings front face furthermore present a hydrophobic property and a powerful affinity like hydrogen bond is not produced among both, a mold-release characteristic is also good and there is almost no danger of the copolymer moldings breakage accompanying mold release.

Therefore, the manufacture method of this invention is useful to manufacture of a contact lens, an intraocular lens, an artificial cornea, etc., and can be preferably applied to especially manufacture of a contact lens.

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TECHNICAL PROBLEM

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[Problem(s) to be Solved by the Invention]

However, when copolymerization of the polyorganosiloxane which has a polymerization nature machine using the mold which has a hydrophobic front face, for example like the mold made from polypropylene, and the monomer which protected the hydroxyl group with the trimethylsilyl machine was carried out, there was a problem that a hydrophilic property was not given while the front face has been hydrophobic even if it hydrolyzes.

With the monomer which has the hydroxyl group with which the cause has especially ester combination of hydroxyalkyl (meta) acrylate etc. If the hydrophobic property of a protective group (protective group) is weak compared with ester combination like a trimethylsilyl machine Although the way of the

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hydrophilic property of ester combination acted strongly and protected from the hydrophobic property of this protective group by the hydrophobic radical The hydrophilic monomer protected by the protective group cannot approach a hydrophobic mould front face like the mold of polypropylene nature easily. Instead, the copolymerization moldings with which the hydrophobic, strong polyorganosiloxane approached the hydrophobic mould front face is obtained, and even if it hydrolyzes to this moldings as a result, a front face is considered that only the hydrophobic lens for eyes is obtained.

The hydrophobic mold produced from synthetic resin, such as polypropylene, on the other hand was easy to produce in a desired configuration with injection molding, and was what it can produce with a sufficient precision also in a mold fabrication side which gives a front face with a sufficient precision required of the lens for eyes, there are many advantages referred to as being easy to receive moreover, and it is hard to throw away as mold for lenses for eyes.

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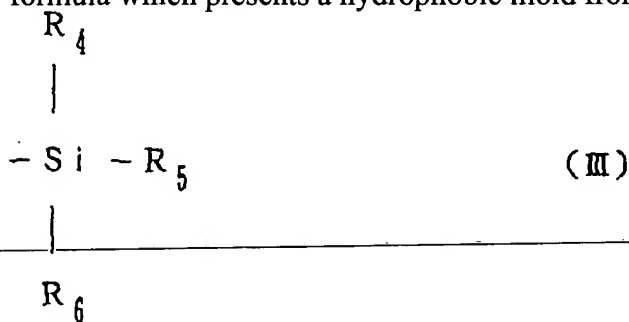
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 CLAIMS
 

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(57) [Claim(s)]

[Claim 1] : The polyorganosiloxane which has a polymerization nature machine, and the general formula which presents a hydrophobic mold front face and hydrophobic compatibility (III)



(Among a formula, it may differ, even if R4, R5, and R6 are the same, and the phenyl group or the number of silicon by which one or more alkyl groups which may be replaced may be replaced for the carbon number shows one or more ORGANO siloxy machines which may be replaced.) R4, R5, and R6 -- simultaneous -- the case of a methyl group -- removing -- the manufacture method of the lens for eyes characterized by carrying out \*\* silanizing of the copolymer moldings obtained by copolymerizing the monomer constituent which makes a principal component the monomer which has the silanized hydroxyl group containing the monomer which protected the hydroxyl group with the hydrophobic silyl machine shown in the mold which has a hydrophobic front face made of synthetic resin [ however, ] [Claim 2] The manufacture method of the lens for eyes given in the 1st term of a patent claim that the polyorganosiloxane which has the aforementioned polymerization nature machine is what has an unsaturation double bond.

[Claim 3] the claim which adds the monomer which protected the hydroxyl group with the hydrophobic silyl machine in which the monomer which has the silanized hydroxyl group containing the monomer which protected the hydroxyl group has a mold front face and compatibility to all the monomer 100 weight sections that have the hydroxyl group which silanized with a hydrophobic silyl machine with the aforementioned mold front face and compatibility more than 10 weight sections -- the manufacture method of the lens for eyes given in the 1st term

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DETAILED DESCRIPTION

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[Detailed Description of the Invention]

[Industrial Application]

this invention relates to the manufacture method of the lens for eyes that the surface hydrophilic property stabilized over the long period of time especially like the contact lens, the intraocular lens, or the artificial cornea also in the lens for eyes prescribed in ophthalmology is needed.

[Description of the Prior Art]

In recent years, the material of a silicone system is mainly used for a contact lens and a flexible intraocular lens material with good oxygen permeability. However, generally the material of a silicone system was unsuitable as a lens material to which \*\*\*\* contacts a hydrophobic property to a living body (eye organization) directly if especially the front face remains water repellence as it is for a \*\*\*\* reason.

Then, the proposal of various improvement proposals, such as giving an electrodischarge treatment to the material of the aforementioned silicone system, in order to make a hydrophilic property give the front face, or carrying out copolymerization of the monomer of a silicone system and the hydrophilic monomer, is made.

However, when surface hydrophilicity-ization gave by the above electrodischarge treatments, while using it, the problem that a hydrophilic property fell was. Moreover, when copolymerization of the monomer of a silicone system and the hydrophilic monomer was carried out, the compatibility of the monomer of a silicone system and a hydrophilic monomer was bad, and the monomer with the strong hydrophobic property of the amount of macromolecules like especially a polyorganosiloxane had the problem that it was very difficult to mix the hydrophilic monomer and homogeneity of only the considerable amount which gives sufficient hydrophilic property for the lens for eyes obtained. If a polymerization is carried out with mixture [ uneven ], it can deal only in an opaque copolymer and cannot be used as a lens for eyes. Although the method of introducing a hydrophilic radical into the monomer of a silicone system, and carrying out a polymerization to other monomers is proposed in order to solve the above problems, the hydrophobic property of a material has come [ then, ] to be improved fundamentally.

Then, as already indicated by JP,61-138613,A, this invention persons In case copolymerization of the polyorganosiloxane which has a polymerization nature machine and a hydrophilic radical, and other monomers is carried out to the same molecule side chain, the monomer which protected the hydroxyl group of the hydrophilic monomer which has a hydroxyl group with the trimethylsilyl machine is used. The compatibility of the polyorganosiloxane and the hydrophilic monomer which have a polymerization nature machine and a hydrophilic radical is improved and copolymerized in the same molecule side chain, and \*\* silanizing (hydrolysis processing) is given to after an appropriate time. Although it has the "sea-bird" structure of a hydrophobic domain and a hydrophilic domain on the micro target obtained, the uniform and transparent charge of oxygen permeability elasticity contact lens material is proposed on the macro target.

On the other hand, the material which makes a polyorganosiloxane a subject is usually considered to be

elasticity, and to be a manufacture means with the most effective forming method by mold, since it is not difficult or processible by the usual cutting method in ordinary temperature (room temperature).

[Problem(s) to be Solved by the Invention]

However, when copolymerization of the polyorganosiloxane which has a polymerization nature machine using the mold which has a hydrophobic front face, for example like the mold made from polypropylene, and the monomer which protected the hydroxyl group with the trimethylsilyl machine was carried out, there was a problem that a hydrophilic property was not given while the front face has been hydrophobic even if it hydrolyzes.

With the monomer which has the hydroxyl group with which the cause has especially ester combination of hydroxyalkyl (meta) acrylate etc. If the hydrophobic property of a protective group (protective group) is weak compared with ester combination like a trimethylsilyl machine Although the way of the hydrophilic property of ester combination acted strongly and protected from the hydrophobic property of this protective group by the hydrophobic radical The hydrophilic monomer protected by the protective group cannot approach a hydrophobic mould front face like the mold of polypropylene nature easily. Instead, the copolymerization moldings with which the hydrophobic, strong polyorganosiloxane approached the hydrophobic mould front face is obtained, and even if it hydrolyzes to this moldings as a result, a front face is considered that only the hydrophobic lens for eyes is obtained.

The hydrophobic mold produced from synthetic resin, such as polypropylene, on the other hand was easy to produce in a desired configuration with injection molding, and was what it can produce with a sufficient precision also in a mold fabrication side which gives a front face with a sufficient precision required of the lens for eyes, there are many advantages referred to as being easy to receive moreover, and it is hard to throw away as mold for lenses for eyes.

Then, this invention persons are between the lens material for eyes, and a mold front face, although tried with how to obtain the good lens for eyes of a surface hydrophilic property by carrying out the surface treatment of the front face of the aforementioned hydrophobic mold to a hydrophilic property by plasma irradiation etc. It became difficult the increase of powerful affinities, such as hydrogen bond, and to release from mold conversely, and when you were going to make it release from mold by force, there was a problem that a moldings will be damaged. When electron beam irradiation and plasma irradiation were furthermore performed to mold, the precision of the forming side of mold became bad and there was also demerit in which the moldings which has the shape of surface type good as a lens for eyes was no longer obtained.

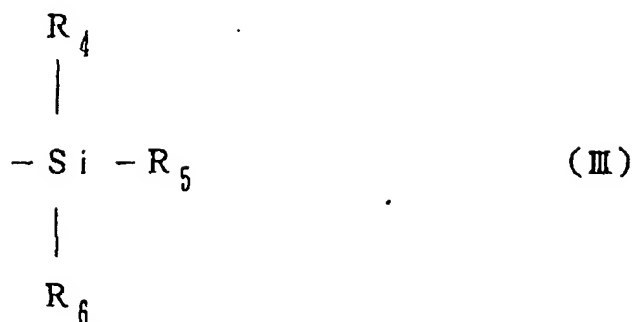
Then, as a result of repeating research wholeheartedly in view of the trouble of the above conventional technology, this invention persons find out the manufacture method which can solve this trouble entirely, and came to complete this invention.

That is, in manufacturing with mold the lens for eyes which makes a polyorganosiloxane etc. a principal component, the place made into the purpose of this invention has surface good water wettability, and its hydrophilic property is stable over a long period of time, and it is to offer the manufacture method of the lens for eyes which does not spoil good physical properties, for example, oxygen permeability, other mechanical strengths, flexibility, etc.

Moreover, the mold-release characteristic at the time of desorbing a lens from mold is also good, and it is offering the manufacture method of the lens for eyes which does not almost have the danger of breakage of the lens for eyes accompanying mold release.

[Means for Solving the Problem]

That is, this invention is general formula (III): which presents the polyorganosiloxane which has a polymerization nature machine, and a hydrophobic mold front face and hydrophobic compatibility.



(Among a formula, it may differ, even if R4, R5, and R6 are the same, and one or more alkyl groups which may be replaced, the phenyl group which may be replaced, or the number of silicon shows [ a carbon number ] one or more ORUGARO siloxy machines which may be replaced.) R4, R5, and R6 -- simultaneous -- the case of a methyl group -- removing -- it is related with the manufacture method of the lens for eyes characterized by carrying out \*\* silanizing of the copolymer moldings obtained by copolymerizing the monomer constituent which makes a principal component the monomer which has the silanized hydroxyl group containing the monomer which protected the hydroxyl group with the hydrophobic silyl machine shown in the mold which has a hydrophobic front face made of synthetic resin [ however, ]

[For \*\* ]

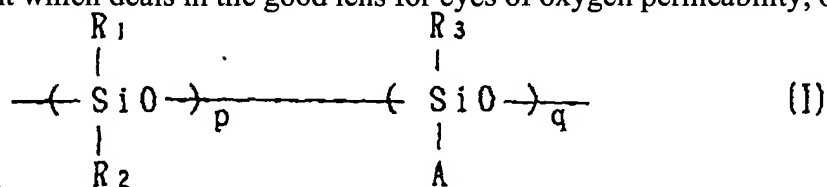
Since the compatibility of the hydrophobic front face of the mold which has a hydrophobic front face made of synthetic resin, and this mold, and the monomer which protected the hydroxyl group with the affinitive hydrophobic silyl machine is good according to this invention, after the hydrophobic silyl machine of this monomer has approached the mold front face, copolymerization is made, and the copolymer moldings with which this hydrophobic silyl machine exists in a front face mostly is obtained. And if hydrolysis processing is performed to this moldings and \*\* silanizing is carried out, a hydroxyl group generates on the surface of a moldings, a front face will be hydrophilic and the good lens for eyes of water wettability will be obtained. Moreover, it differs from the case where, as for the lens for eyes obtained in this way, hydrophilicity-ized processing by the electron ray, plasma, etc. is performed since a hydrophilic portion generates not only to the front face but to the interior by \*\* silanizing and exists in it, there is no concern of degradation of a surface hydrophilic property by wear of the lens for eyes in use etc., and the hydrophilic property stabilized over the long period of time can be maintained. And a mechanical strength, other the good physical properties, for example, oxygen permeability, of the lens for eyes, flexibility, etc. are not spoiled as a result.

Moreover, since a mold front-face and moldings front face is also hydrophobic and a powerful affinity (combination) like hydrogen bond is not produced among both, a mold-release characteristic is also good and the danger of breakage of the copolymer moldings accompanying mold release is very small.

[Example]

The monomer which has the silanized hydroxyl group containing the monomer which protected the hydroxyl group with the hydrophobic silyl machine with the polyorganosiloxane which has a polymerization nature machine in this invention and a mold front face, and compatibility is used as a principal component of a monomer constituent.

The polyorganosiloxane (henceforth a polyorganosiloxane (A)) which has the aforementioned polymerization nature machine is general formula (I): as this polyorganosiloxane (A), although it is especially useful as a component which deals in the good lens for eyes of oxygen permeability, or the



good lens for eyes of flexibility.

(Being a number for the basis and A which were chosen from the alkyl group of C1-C4 that R1, R2, and R3 are the same or of a different kind, the trimethyl siloxane machine, and the phenyl group expressing p among a formula, and a polymerization nature machine and q expressing the content of a

$$0.0001 \leq \frac{q}{p+q} \leq 0.1$$

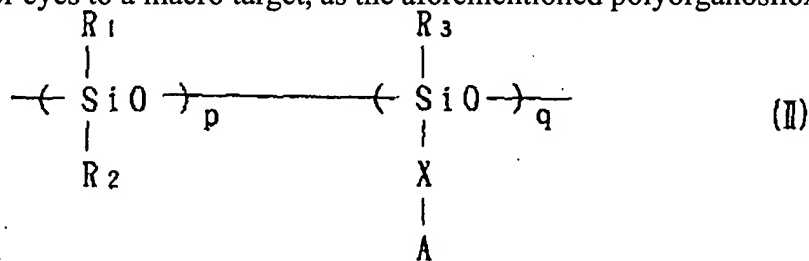
polymerization nature machine.)

the integer which carries out \*\* satisfactory -- being shown -- the polysiloxane which has the structural unit expressed is raised

As for the average molecular weight of the polyorganosiloxane which has a polymerization nature machine, it is desirable that it is in between [ about 5,000 to 200,000 ]. If molecular weight is too smaller than this range, the polyorganosiloxane which does not contain a polymerization nature machine will also be intermingled, and a polymerization or since it becomes becoming (or impossible) that it is hard to construct a bridge, it will become what forming performance is [ a thing ] inferior (it is hard coming to fabricate as a lens for eyes). Then, although molecular weight is small, if the number of polymerization nature machines is increased, the flexibility will be lost and the lens for eyes obtained will become weak. On the other hand, if molecular weight is too larger than the range of previous, unarranging will produce it in respect of handling of being hard coming to mix the monomer which the viscosity of a polyorganosiloxane becomes high and has the single-sized hydroxyl group, other monomers, etc. uniformly.

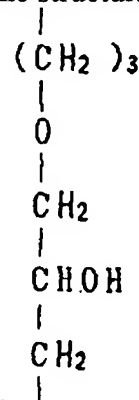
Since this polyorganosiloxane (A) has at least one polymerization nature machine in a molecule side chain, copolymerization with other various monomers is possible for it, and it can deal in the copolymer moldings which gives the physical properties suitable for the desired lens for eyes. When it has at least two polymerization nature machines in the molecule side chain of a polyorganosiloxane (A), it has the capacity (cross-linking ability) which the copolymer itself makes construct a bridge, and own mechanical (dynamic) intensity and configuration stability, own endurance, etc. of a copolymer can be raised by constructing a bridge.

Moreover, in order to raise compatibility with other monomers and to sell the transparent and homogeneous lens for eyes to a macro target, as the aforementioned polyorganosiloxane (A), it is



general formula (II):

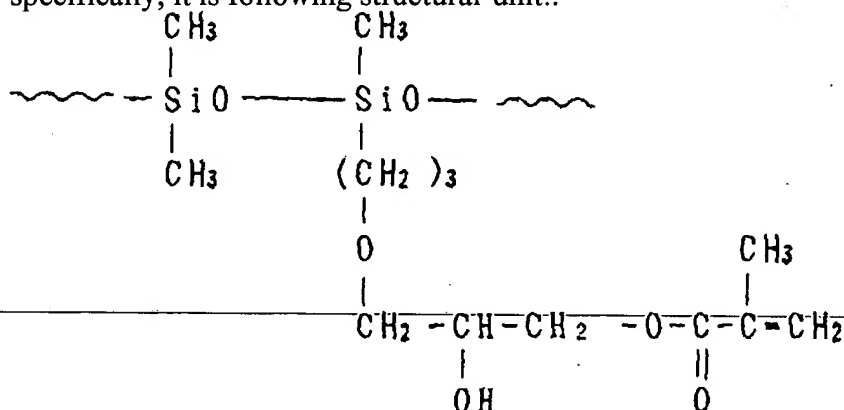
(-- the inside of a formula, and R1, R2, R3, p, q and A -- the above -- the same -- X shows a hydrophilic radical content portion -- you may use the polysiloxane which has the structural unit expressed with)



As a hydrophilic radical content portion, it is formula:, for example.

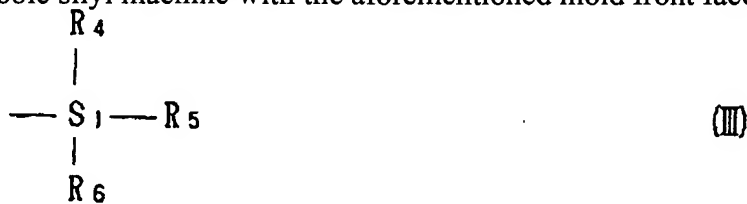
\*\* -- the portion containing the portion which has a hydroxyl group and ether linkage like or the amino group, a carboxyl group, a sulfonic group, amide combination, a urea bond, a urethane bond, a sulfonyl machine, a lactam ring, etc. can be considered

What inserted in the polyorganosiloxane (concretely preferably poly dimethylsiloxane) the functional group which contains polymerization nature unsaturation double bonds, such as an acryloyl machine, a vinyl group, and an allyl group, as a polymerization nature machine (meta) is raised. As the polyorganosiloxane (A) which has the structural unit expressed especially with a general formula (II) For example, the polyorganosiloxane (henceforth a polyorganosiloxane (B)) which has at least one epoxy group (preferably glycidyl group), and the thing obtained by the reaction with a polymerization nature machine content compound (unsaturation machine content compounds, for example, (meta), an acrylic acid, such as an unsaturation double bond) are raised to a molecule side chain, and, more specifically, it is following structural-unit:.



What \*\*\*\*\* is raised.

In the monomer which has the silanized hydroxyl group containing the monomer which protected the hydroxyl group with the hydrophobic silyl machine which presents compatibility for the mold front face of the aforementioned hydrophobic property The monomer which protected the hydroxyl group with the hydrophobic silyl machine which presents especially a mold front face and compatibility is used because the copolymer moldings with which the compatibility of the mold which has a hydrophobic front face made of synthetic resin, and a this mold front face and the monomer which protected the hydroxyl group with the hydrophobic silyl machine which presents compatibility becomes good, copolymerization is made after the hydrophobic silyl machine of this monomer has approached the mold front face, and this hydrophobic silyl machine exists in a front face mostly is obtained. And if hydrolysis processing is performed to this moldings and \*\* silanizing is carried out, a hydroxyl group will generate on the surface of a moldings, and the good lens for eyes of water wettability with which a front face presents a hydrophilic property will be obtained. And a mechanical strength, other the good physical properties, for example, oxygen permeability, of the lens for eyes, flexibility, etc. are not spoiled as a result. Since a mold front-face and moldings front face also presents a hydrophobic property and both sides do not have a powerful affinity (bonding strength) like hydrogen bond, a mold-release characteristic is good and, moreover, the danger of breakage of the lens for eyes accompanying mold release is also still smaller. As a hydrophobic silyl machine with the aforementioned mold front face and compatibility, it is general



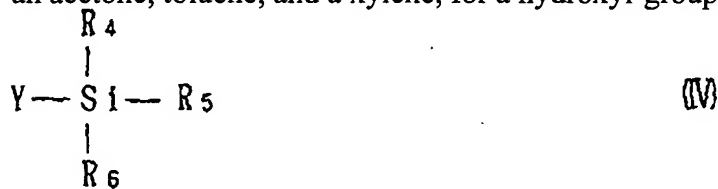
formula (III):.

(Among a formula, it may differ, even if R<sub>4</sub>, R<sub>5</sub>, and R<sub>6</sub> are the same, and one or more alkyl groups

which may be replaced, the phenyl group which may be replaced, or the number of silicon shows [ the number of ureas ] one or more ORGANO siloxy machines which may be replaced.) R4, R5, and R6 -- simultaneous -- the case of a methyl group -- removing -- a hydrophobic silyl machine with larger molecular weight than a trimethylsilyl machine as shown raises -- having -- as the example of this hydrophobic silyl machine [ however, ] \*\*, a triethyl silyl machine, t-butyldimethylsilyl machine, n-octyl dimethylsilyl machine, a phenyl dimethylsilyl machine, a trimethylsiloxy dimethylsilyl machine, etc. are raised.

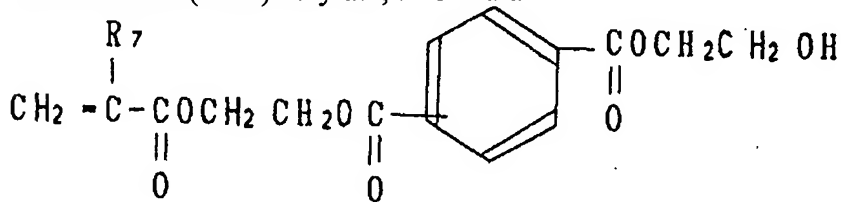
The monomer which protected the hydroxyl group with the above hydrophobic silyl machines is obtained by introducing the aforementioned hydrophobic silyl machine into a hydroxyl-group content hydrophilic-property monomer.

That is, the monomer which protected the hydroxyl group with the aforementioned hydrophobic silyl machine is general formula (IV): in the non-polar solvent which does not have hydroxyl groups, such as an acetone, toluene, and a xylene, for a hydroxyl-group content hydrophilic-property monomer.



It is obtained by making it react with the trio luanot silyl halogenated compound expressed with (the inside of a formula and Y are a halogen atom, and R4, R5, and R6 are the same as R4, R5, and R6 of the aforementioned general formula (III)), or hexa ORUGANO-disilazane.

As the example of the aforementioned hydroxyl-group content hydrophilic-property monomer For example, hydroxyethyl (meta) acrylate, hydroxypropyl (meta) acrylate, Hydroxyalkyl (meta) acrylate, such as hydroxy butyl (meta) acrylate; 2 and 3-dihydroxy-2-methylpropyl (meta) acrylate; 2, 3-dihydroxy propyl (Meta) dihydroxy alkyl (meta) acrylate [ , such as acrylate, ]; -- hydroxy aryl (meta) acrylate [ , such as 2-dihydroxy-3-(meth)acryloyloxy naphthalene, ]; -- diethylene-glycol monochrome (meta) acrylate -- Triethylene-glycol monochrome (meta) acrylate, Propylene-glycol monochrome Hydroxy, such as acrylate (Meta) Alkylene glycol monochrome (Poly) (Meta) acrylate; -- glycerol (poly) monochrome (meta) acrylate [ , such as JIGURISE roll monochrome (meta) acrylate, ]; -- alkoxy (poly) glycerol monochrome (meta) acrylate, such as 2-ethyl HEKISOKISHI glycerol monochrome (meta) acrylate, -- Aryloxy (poly) glycerol monochrome (meta) acrylate, such as phenoxy glycerol monochrome (meta) acrylate; : Formula

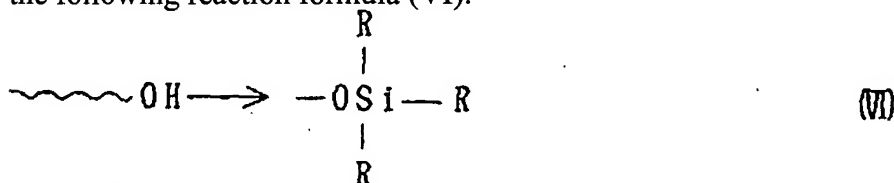


The hydroxyl-group content (meta) acrylate represented with the monomer shown by (the inside of a formula and R7 are a hydrogen atom or a methyl group), unsaturated carboxylic acids, such as an acrylic acid (meta), etc. are raised.

In order for the monomer which has the hydroxyl group by which it was silanized other than the monomer which protected the hydroxyl group with the hydrophobic silyl machine with the aforementioned mold front face and compatibility to raise the surface hydrophilic property (water wettability) of the lens for eyes after carrying out \*\* silanizing (hydrolysis) of the copolymer moldings and to maintain underwater transparency. Although added, when this monomer is added, the mechanical (dynamic) intensity of the lens for eyes can be raised further. In the solvent used when dealing in the monomer which protected the hydroxyl group for the aforementioned hydroxyl-group content hydrophilic-property monomer with the aforementioned hydrophobic silyl machine, this monomer is

obtained by making it react with trialkylsilyl halogenides, such as a trimethylchlorosilane.

In addition, silanizing of the hydroxyl group in a hydroxyl-group content aquosity monomer advances as the following reaction formula (VI).



(or [ the inside of a formula, and / that R is the same as either of the above R4-R6 ] -- or it is a methyl group) .

The monomer which has the hydroxyl group which silanized may be a monomer which protected the hydroxyl group with the hydrophobic silyl machine with all that hydrophobic mold front face and compatibility, and may use together the aforementioned mold front face, the monomer which protected the hydroxyl group with the affinitive hydrophobic silyl machine, and the monomer which has the hydroxyl group which others silanized. However, when using together, it is good to use preferably the monomer which protected the hydroxyl group with the hydrophobic silyl machine with a mold front face and compatibility at a rate of 20 - 70 weight section more than 10 weight sections to all the monomer 100 weight sections that have the hydroxyl group which silanized. When there are few operating rates of the monomer which protected the hydroxyl group with the hydrophobic silyl machine with a mold front face and compatibility than 10 weight sections, the polyorganosiloxane which presents a hydrophobic property strong against the place which touches the mold which has a hydrophobic front face made of synthetic resin gathers mostly, and even if it carries out \*\* silanizing (hydrolysis), the lens for eyes which has the front face of a hydrophilic property is no longer obtained.

the operating rate (monomer which has the polyorganosiloxane which has a polymerization nature machine / hydroxyl group which silanized) of the monomer which has the polyorganosiloxane which has the aforementioned polymerization nature machine, and the hydroxyl group which silanized -- a weight ratio -- 50 / 50 - 95/5 -- 70 / 30 - 90/10 are preferably suitable If the operating rate of the polyorganosiloxane which has the aforementioned polymerization nature machine becomes less than 50 weight sections While the lens for eyes which fully has oxygen permeability or flexibility is no longer obtained, when non-water nature or low water nature will no longer be maintained and it will have water nature equivalent to the usual lens for water \*\*\*\* (for example, polymer which consists of hydroxyethyl methacrylate as a principal component), you have to come to give disinfection by boiling etc. if needed. Moreover, if the operating rate of the polyorganosiloxane which has the aforementioned polymerization nature machine increases more than 95 weight sections, the operating rate of the monomer which has the hydroxyl group which silanized in phase-splitting pair will decrease, and the lens for eyes with which a front face presents a hydrophilic property as a result will become is hard to be obtained.

In addition to the monomer which has the polyorganosiloxane which has a polymerization nature machine, and the water acidity which silanized The need is accepted. For example, styrene, and an alpha methyl styrene, t-butyl styrene, The hydrophobic monomer which has a ring like alkyl styrene, such as isopropyl styrene, or benzyl methacrylate, Methyl (meta) acrylate, ethyl (meta) acrylate, propyl (meta) acrylate, Even if butyl (meta) acrylate, hexyl (meta) acrylate, 2-ethylhexyl (meta) acrylate, truffle RUORO ethyl (meta) acrylate, dodecyl (meta) acrylate, etc. are replaced. Good alkyl (meta) acrylate; you may add alkyl crotonate;N, such as alkyl itaconate; propyl crotonate, such as alkoxy (poly) alkylene glycol (meta) acrylate; dimethyl itaconate, such as methoxy diethylene-glycol (meta) acrylate and ethoxy tripropylene glycol (meta) acrylate, and diethyl itaconate, N-dimethyl (meta) acrylamide, N vinylpyrrolidone, etc.

The amount used to all the monomer component 100 weight sections of the above and other monomers is 0 - 25 weight section, and it is desirable to carry out 5 weight sections content at least from the field of raising intensity.

When the monomer which has the hydroxyl group which especially silanized when it is used in addition

to the monomer which has the polyorganosiloxane (A) which has the aforementioned polymerization nature for the hydrophobic monomer which has a ring among these monomers, and the hydroxyl group which silanized, and the hydrophobic monomer which has a ring are used together, the intensity of material can be raised by leaps and bounds according to the synergistic effect.

Moreover, when using the hydrophobic monomer which has especially a ring, in order to fully demonstrate the effect of this monomer, as for the operating rate (filtered-water nature monomer which has the monomer/ring which has the hydroxyl group which silanized) of the monomer which silanized, and the hydrophobic monomer which has a ring, it is desirable that it is in the range of 1 / 1 - 3/1 by the weight ratio.

The polymerization fabrication method of the monomer constituent which consists of the above and other monomers by the monomer and request which have the polyorganosiloxane which has the aforementioned polymerization nature machine, and the hydroxyl group which silanized is performed by the usual mould method. That is, it carries out whether the aforementioned monomer constituent is mixed, a polymerization initiator is added to this, the combination liquid which it comes to mix uniformly is calmly poured into it into a concave, a concave convex type is carried, and it inserts by the clamp etc., or a weight is carried on mold, a concave and a convex type are bound tight moderately, and if this mold is put into the suitable container for polymerizations, and is heated or an electromagnetic wave is irradiated, the polymerization of the combination liquid is When heating, that what is necessary is to heat for several hours to dozens hours, and just to carry out a polymerization at about 40-90 degrees C (there is a possibility that the mold made of synthetic resin may deform when temperature is higher than about 90 degrees C), if needed, a temperature up may be carried out gradually and a polymerization may be carried out. In order to complete a polymerization good, a deoxidant may be put in in the aforementioned container for polymerizations, and a polymerization may be carried out and carried out to reduced pressure. Mold is cooled after polymerization completion, a concave and a convex type are separated, and the copolymer moldings fabricated in the shape of a lens from mold is exfoliated. In this case, you may remove a copolymer moldings from casting in the solvent which does not have a bad influence on copolymer moldingses, such as alcohol and an acetone, if needed.

Although the mold which has a hydrophobic front face made of synthetic resin is used as the aforementioned mold, although polypropylene, polyethylene, polystyrene, the Poti vinyl chloride, polytetrafluoroethylene, poly 3 fluoride-salt-ized ethylene, etc. are raised, for example, as the quality of the material, polypropylene is desirable also in these. It is easy to carry out injection molding of the hydrophobic mold produced from synthetic resin, such as the aforementioned polypropylene, to a mold configuration, and it can produce mold which gives a front face with a sufficient precision required of the lens for eyes with a sufficient precision, has the various advantages of moreover being easy to receive, and is very useful as mold for lenses for eyes. This mold has a forming side of specification (radius of curvature, a diameter, thickness, etc.) where the lens for eyes which the inside makes the purpose is obtained, and is produced by injection molding etc. by making a concave and a convex type into a lot.

Next, \*\* silanizing is given to the copolymer moldings obtained in this way.

\*\* silanizing (hydrolysis processing) is performed by heating the obtained copolymer moldings in alcoholic usual solution. Extraction removal of the unnecessary resultant which furthermore heated the lens for eyes in alcoholic solution etc. using the extractor, and was generated by the unreacted object and

\*\* silanizing in polymerization reaction is carried out. By desorbing a silyl machine and making a hydroxyl group generate by this processing, the surface hydrophilic property (water wettability) stabilized for a long period of time can be given to the lens for eyes.

As alcohol used for a \*\* silanizing reaction, a methanol, ethanol, propanol, etc. are raised and an isopropanol with the nearest property etc. is especially desirable to a non-polar solvent. The reason the alcoholic aforementioned solution is alcohol which contains water about 1 to 40%, and alcoholic solution is used, Alcoholic solution has a hydrophobic polyorganosiloxane, a hydrophobic silyl machine, and good compatibility, and is because \*\* silanizing can be efficiently advanced in a copolymer moldings and extraction removal of the unreacted object of an important reaction or the unnecessary

product by \*\* silanizing can be easily performed, since some copolymer moldings are moreover made to swell.

Subsequently, it is made to once dry and the obtained lens for eyes is saved by being immersed into solution, such as a physiological saline, after that, in order to remove the solvent used for extraction processing.

Although the manufacture method of the lens for eyes of this invention is further explained to a detail based on an example below, this invention is not limited only to this example. (Composition of the monomer which protected the hydroxyl group with the hydrophobic silyl machine with a mold front face and compatibility)

Synthetic example 1 2-hydroxyethyl methacrylate 33g, triethylamine 25g, and acetone 500ml were \*\*\*\* (ed) to the Erlenmeyer flask. While ice cools a flask, it continues agitating, what dissolved t-butyldimethyl chlorosilane 38g in acetone 50ml is dropped there, and the reaction was advanced for about 3 hours, keeping at 10 degrees C or less.

After removing 3 N-HCl which is a resultant ( $\text{CH}_3\text{CH}_2$ ) from reaction mixture, 2-hydroxyethyl methacrylate 17.9g (62 degrees C / 0.15mmHg) which removed the solvent further, distilled and was formed into t-butyldimethylsilyl was obtained. It checked that it was 2-hydroxyethyl methacrylate formed into t-butyldimethylsilyl by infrared-absorption-spectrum analysis etc. The purity was 98.1% when the gas chromatography analyzed.

Synthetic example 2 2-hydroxyethyl methacrylate 33g, triethylamine 25g, and acetone 500ml were \*\*\*\* (ed) to the Erlenmeyer flask. While ice cools a flask, it continues agitating, octyl dimethyl chlorosilane 52g is dropped there, and the reaction was advanced for about 3 hours, keeping at 10 degrees C or less.

2-hydroxyethyl-methacrylate-25.5g-(109-degrees-C/-0.2mmHg)-formed-into-octyl-dimethylsilyl-was obtained like the example 1 of reference. It checked that it was 2-hydroxyethyl methacrylate formed into octyl dimethylsilyl by infrared-absorption-spectrum analysis etc. The purity was 97.4% when the gas chromatography analyzed.

Synthetic example 3 Like the example 1 of reference, triethyl chlorosilane 50g and 2-hydroxyethyl methacrylate 44g were made to react, and triethyl-silyl-ized 2-hydroxyethyl methacrylate 38.0g (98.4% of purity) was obtained.

(Manufacture of the polyorganosiloxane which has polymerization nature)

Synthetic example 4 Hydroquinone monomethyl ether 0.3g was put into 3 mouth flask as polyorganosiloxane (0.4% [ of glycidyl group content ], Shin-Etsu Chemical Co., Ltd. make) 60g which has a glycidyl group in the molecule side chain of molecular weight 70,000 [ about ], 120g of methacrylic acids, and a polymerization inhibitor, and it was made to react to 123-131 degrees C for 90 minutes.

Subsequently, n-hexane 4.5\*\* was added to the obtained reaction mixture, and it washed by 1% sodium-hydroxide solution 5\*\*. After washing by water 5\*\* furthermore, sulfuric-anhydride magnesium was added and dried, magnesium sulfate was carried out the \*\* exception, reduced pressure removal of the n-hexane was carried out, and 57.2g (polyorganosiloxane which has a polymerization machine) of composts was obtained.

light yellow with the obtained viscous compost -- it was a transparent liquid (henceforth Sil)

Example 1 With injection molding, the concave which has a predetermined configuration (configuration which gives base curve 8.4mm and a contact lens with a diameter of 13.5mm), and the convex type mould type for lens molding were produced using polypropylene resin.

as the Sil70 weight section obtained in the synthetic example 4, the 2-hydroxyethyl methacrylate 20 weight section which was obtained in the synthetic example 1 and which was formed into t-butyldimethylsilyl, the styrene 10 weight section, and a polymerization initiator -- the 2 and 2'-azobis (2,4-dimethylvaleronitrile) 0.4 weight section -- mixing -- mixed liquor -- the first half -- the inside of the concave for fabrication -- a foam -- winding -- the top -- what -- several drops were calmly dropped like It came out for 10 degrees C after put in the this mold after carrying the convex type next into the container for polymerizations, carrying a weight on it, putting in about 10g of deoxidants into this container, making it reduced pressure and heating at 50 degrees C in a hot blast formula circulation

dryer for 8.5 hours / 90 minutes comparatively, the temperature up was gradually carried out to 90 degrees C, it heated for about 15 hours, and copolymerization was carried out.

After \*\*\*\*, the convex type of mold and the concave were pulled apart and the copolymer moldings was exfoliated from mold. Ablation of the copolymer moldings from mold was very easy, solvents, such as alcohol, did not need to be made immersed, it did not need to exfoliate and the mold-release characteristic was good. The hardening state by the polymerization of a copolymer moldings is also good, and it had the desired lens configuration.

Next, the copolymer moldings was boiled in 90% isopropanol solution, hydrolysis processing was performed, and the silyl machine was desorbed. Furthermore, this copolymer moldings was boiled in 90% isopropanol solution using the Soxhlet extractor, extraction removal of an unreacted object or the unnecessary product by \*\* silanizing was carried out, the obtained lens was dried after that, the lens was immersed into the physiological saline, and the contact lens was obtained.

The obtained contact lens was transparent and colorless, configuration stability is good and the water wettability (surface hydrophilic property) of a lens was [ it had sufficient stability also to bending and ] also good.

The contact angle of the obtained contact lens, a thrust pilferage pile, a pace of expansion, and the result that measured the thickness of a center section, oxygen permeability, etc. mostly are shown in the 1st table.

In addition, the various physical properties of the obtained lens for eyes were measured according to the following methods.

(Mold-release characteristic)

It judged whether a copolymer moldings will tend to exfoliate from mold-release. When ablation was easy, the mold-release characteristic presupposed that it is good, so that solvents, such as alcohol, did not need to be made immersed and it did not need to exfoliate. When that it is difficult to exfoliate even if it supposes that a mold-release characteristic is almost good and makes solvents, such as alcohol, immersed when there is a thing with the need of making solvents, such as alcohol, immersed and exfoliating, or impossible, the mold-release characteristic presupposed that it is poor.

(Hardening state)

The hardening state (did the polymerization advance good or not?) of the copolymer moldings released from mold was observed with the naked eye.

(The shape of form )

The configuration of the lens in the immersing state in a physiological saline was observed with the naked eye.

(Water wettability)

The lens of an immersing state was taken out from the physiological saline in the physiological saline, and the state of wetting on the front face of a lens was observed with the naked eye.

(Contact angle)

The contact angle (wettability) to the water on the front face of a lens was measured by the cellular method.

(Transparency)

The transparency of the lens in the immersing state in a physiological saline was observed by naked eye nature.

(Thrusting load)

With the Instron type compression tester, the press needle with a diameter of 1/16 inch was applied to the abbreviation center section of the lens fixed in the state of being immersed in the physiological saline, and the load at the time of fracture was measured.

(Pace of expansion)

The pace of expansion to the length of the basis at the time of fracture of the lens when measuring the above-mentioned thrust pilferage pile was measured.

(Oxygen transmission coefficient)

By the \*\*\*\*\* type film oxygen penetrometer (product made from \*\*\*\*\* Machine Industry), it

measured at 35 degrees C among the physiological saline.

Examples 2-3 As shown in the 1st table, various components were blended, and the contact lens was produced like the example 1.

## \* NOTICES \*

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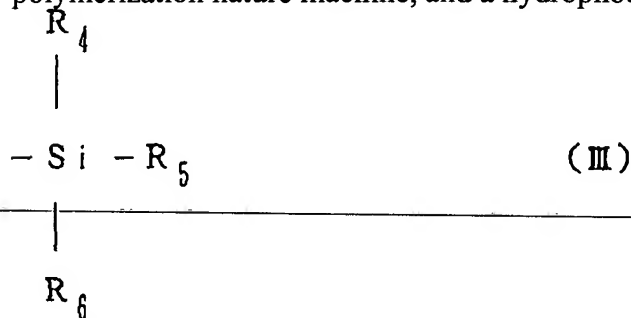
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MEANS

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[Means for Solving the Problem]

That is, this invention is general formula (III): which presents the polyorganosiloxane which has a polymerization nature machine, and a hydrophobic mold front face and hydrophobic compatibility.



(Among a formula, it may differ, even if R<sub>4</sub>, R<sub>5</sub>, and R<sub>6</sub> are the same, and one or more alkyl groups which may be replaced, the phenyl group which may be replaced, or the number of silicon shows [ a carbon number ] one or more ORUGARO siloxy machines which may be replaced.) R<sub>4</sub>, R<sub>5</sub>, and R<sub>6</sub> -- simultaneous -- the case of a methyl group -- removing -- it is related with the manufacture method of the lens for eyes characterized by carrying out \*\* silanizing of the copolymer moldings obtained by copolymerizing the monomer constituent which makes a principal component the monomer which has the silanized hydroxyl group containing the monomer which protected the hydroxyl group with the hydrophobic silyl machine shown in the mold which has a hydrophobic front face made of synthetic resin [ however, ]

[For \*\*]

Since the compatibility of the hydrophobic front face of the mold which has a hydrophobic front face made of synthetic resin, and this mold, and the monomer which protected the hydroxyl group with the affinitive hydrophobic silyl machine is good according to this invention, after the hydrophobic silyl machine of this monomer has approached the mold front face, copolymerization is made, and the copolymer moldings with which this hydrophobic silyl machine exists in a front face mostly is obtained. And if hydrolysis processing is performed to this moldings and \*\* silanizing is carried out, a hydroxyl group generates on the surface of a moldings, a front face will be hydrophilic and the good lens for eyes of water wettability will be obtained. Moreover, it differs from the case where, as for the lens for eyes obtained in this way, hydrophilicity-ized processing by the electron ray, plasma, etc. is performed since a hydrophilic portion generates not only to the front face but to the interior by \*\* silanizing and exists in it, there is no concern of degradation of a surface hydrophilic property by wear of the lens for eyes in use etc., and the hydrophilic property stabilized over the long period of time can be maintained. And a mechanical strength, other the good physical properties, for example, oxygen permeability, of the lens for eyes, flexibility, etc. are not spoiled as a result. Moreover, since a mold front-face and moldings front face is also hydrophobic and a powerful affinity

(combination) like hydrogen bond is not produced among both, a mold-release characteristic is also good and the danger of breakage of the copolymer moldings accompanying mold release is very small.

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[Translation done.]

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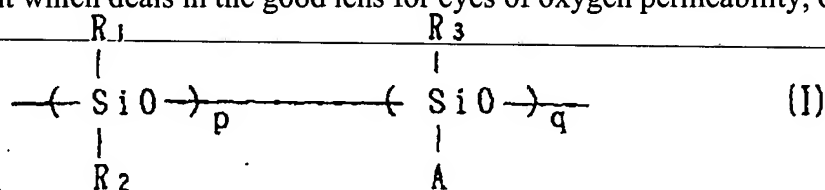
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## EXAMPLE

## [Example]

The monomer which has the silanized hydroxyl group containing the monomer which protected the hydroxyl group with the hydrophobic silyl machine with the polyorganosiloxane which has a polymerization nature machine in this invention and a mold front face, and compatibility is used as a principal component of a monomer constituent.

The polyorganosiloxane (henceforth a polyorganosiloxane (A)) which has the aforementioned polymerization nature machine is general formula (I): as this polyorganosiloxane (A), although it is especially useful as a component which deals in the good lens for eyes of oxygen permeability, or the



good lens for eyes of flexibility.

(Being a number for the basis and A which were chosen from the alkyl group of C1-C4 that R1, R2, and R3 are the same or of a different kind, the trimethyl siloxane machine, and the phenyl group expressing p among a formula, and a polymerization nature machine and q expressing the content of a

$$0.0001 \leq \frac{q}{p+q} \leq 0.1$$

polymerization nature machine.)

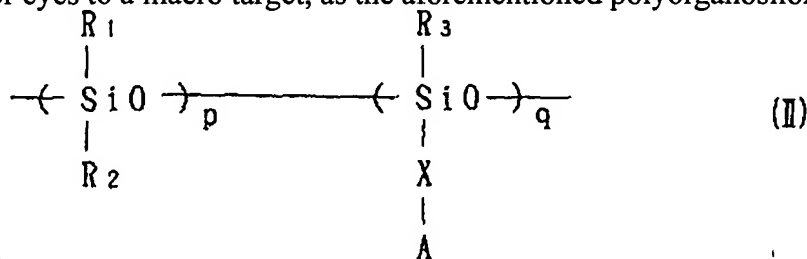
the integer which carries out \*\* satisfactory -- being shown -- the polysiloxane which has the structural unit expressed is raised

As for the average molecular weight of the polyorganosiloxane which has a polymerization nature machine, it is desirable that it is in between [ about 5,000 to 200,000 ]. If molecular weight is too smaller than this range, the polyorganosiloxane which does not contain a polymerization nature machine will also be intermingled, and a polymerization or since it becomes becoming (or impossible) that it is hard to construct a bridge, it will become what forming performance is [ a thing ] inferior (it is hard coming to fabricate as a lens for eyes). Then, although molecular weight is small, if the number of polymerization nature machines is increased, the flexibility will be lost and the lens for eyes obtained will become weak. On the other hand, if molecular weight is too larger than the range of previous, unarranging will produce it in respect of handling of being hard coming to mix the monomer which the viscosity of a polyorganosiloxane becomes high and has the single-sized hydroxyl group, other monomers, etc. uniformly.

Since this polyorganosiloxane (A) has at least one polymerization nature machine in a molecule side chain, copolymerization with other various monomers is possible for it, and it can deal in the copolymer moldings which gives the physical properties suitable for the desired lens for eyes. When it has at least two polymerization nature machines in the molecule side chain of a polyorganosiloxane (A), it has the

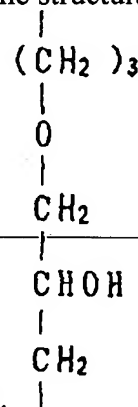
capacity (cross-linking ability) which the copolymer itself makes construct a bridge, and own mechanical (dynamic) intensity and configuration stability, own endurance, etc. of a copolymer can be raised by constructing a bridge.

Moreover, in order to raise compatibility with other monomers and to sell the transparent and homogeneous lens for eyes to a macro target, as the aforementioned polyorganosiloxane (A), it is



general formula (II):.

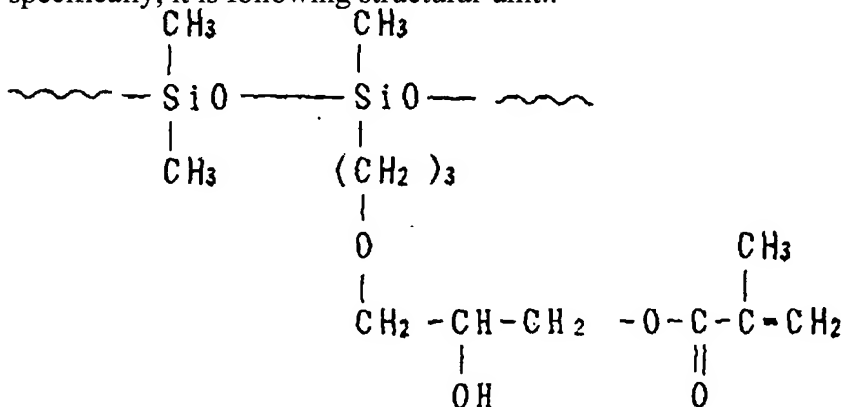
(-- the inside of a formula, and R1, R2, R3, p, q and A -- the above -- the same -- X shows a hydrophilic radical content portion -- you may use the polysiloxane which has the structural unit expressed with)



As a hydrophilic radical content portion, it is formula:, for example.

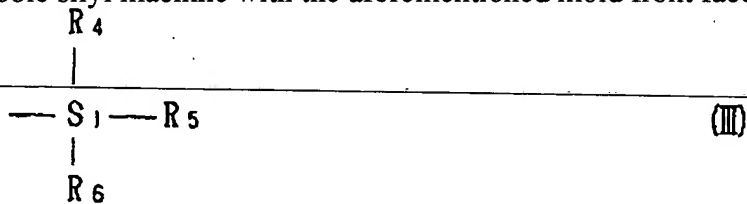
\*\* -- the portion containing the portion which has a hydroxyl group and ether linkage like or the amino group, a carboxyl group, a sulfonic group, amide combination, a urea bond, a urethane bond, a sulfonyl machine, a lactam ring, etc. can be considered

What inserted in the polyorganosiloxane (concretely preferably poly dimethylsiloxane) the functional group which contains polymerization nature unsaturation double bonds, such as an acryloyl machine, a vinyl group, and an allyl group, as a polymerization nature machine (meta) is raised. As the polyorganosiloxane (A) which has the structural unit expressed especially with a general formula (II) For example, the polyorganosiloxane (henceforth a polyorganosiloxane (B)) which has at least one epoxy group (preferably glycidyl group), and the thing obtained by the reaction with a polymerization nature machine content compound (unsaturation machine content compounds, for example, (meta), an acrylic acid, such as an unsaturation double bond) are raised to a molecule side chain, and, more specifically, it is following structural-unit:.



What \*\*\*\*\* is raised.

In the monomer which has the silanized hydroxyl group containing the monomer which protected the hydroxyl group with the hydrophobic silyl machine which presents compatibility for the mold front face of the aforementioned hydrophobic property The monomer which protected the hydroxyl group with the hydrophobic silyl machine which presents especially a mold front face and compatibility is used because the copolymer moldings with which the compatibility of the mold which has a hydrophobic front face made of synthetic resin, and a this mold front face and the monomer which protected the hydroxyl group with the hydrophobic silyl machine which presents compatibility becomes good, copolymerization is made after the hydrophobic silyl machine of this monomer has approached the mold front face, and this hydrophobic silyl machine exists in a front face mostly is obtained. And if hydrolysis processing is performed to this moldings and \*\* silanizing is carried out, a hydroxyl group will generate on the surface of a moldings, and the good lens for eyes of water wettability with which a front face presents a hydrophilic property will be obtained. And a mechanical strength, other the good physical properties, for example, oxygen permeability, of the lens for eyes, flexibility, etc. are not spoiled as a result. Since a mold front-face and moldings front face also presents a hydrophobic property and both sides do not have a powerful affinity (bonding strength) like hydrogen bond, a mold-release characteristic is good and, moreover, the danger of breakage of the lens for eyes accompanying mold release is also still smaller. As a hydrophobic silyl machine with the aforementioned mold front face and compatibility, it is general

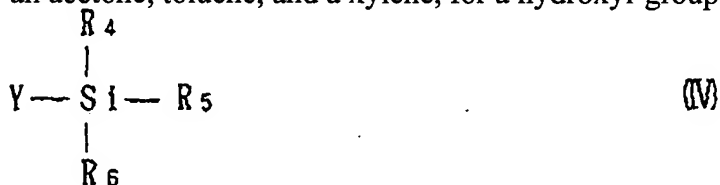


formula (III):.

(Among a formula, it may differ, even if R4, R5, and R6 are the same, and one or more alkyl groups which may be replaced, the phenyl group which may be replaced, or the number of silicon shows [ the number of ureas ] one or more ORGANO siloxy machines which may be replaced.) R4, R5, and R6 -- simultaneous -- the case of a methyl group -- removing -- a hydrophobic silyl machine with larger molecular weight than a trimethylsilyl machine as shown raises -- having -- as the example of this hydrophobic silyl machine [ however, ] \*\*, a triethyl silyl machine, t-butyl dimethylsilyl machine, n-octyl dimethylsilyl machine, a phenyl dimethylsilyl machine, a trimethylsiloxy dimethylsilyl machine, etc. are raised.

The monomer which protected the hydroxyl group with the above hydrophobic silyl machines is obtained by introducing the aforementioned hydrophobic silyl machine into a hydroxyl-group content hydrophilic-property monomer.

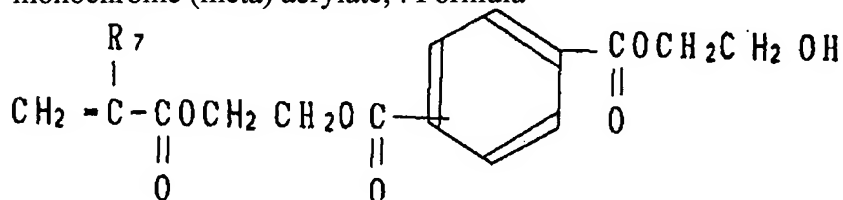
That is, the monomer which protected the hydroxyl group with the aforementioned hydrophobic silyl machine is general formula (IV): in the non-polar solvent which does not have hydroxyl groups, such as an acetone, toluene, and a xylene, for a hydroxyl-group content hydrophilic-property monomer.



It is obtained by making it react with the trio luganot silyl halogenated compound expressed with (the inside of a formula and Y are a halogen atom, and R4, R5, and R6 are the same as R4, R5, and R6 of the aforementioned general formula (III)), or hexa ORUGANO disilazane.

As the example of the aforementioned hydroxyl-group content hydrophilic-property monomer For example, hydroxyethyl (meta) acrylate, hydroxypropyl (meta) acrylate, Hydroxyalkyl (meta) acrylate,

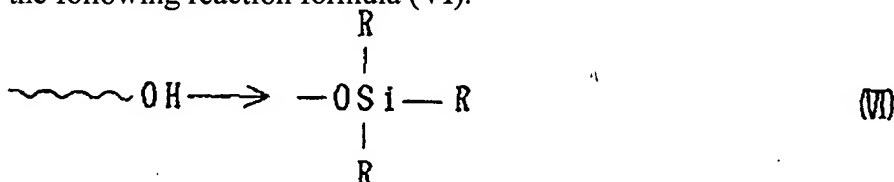
such as hydroxy butyl (meta) acrylate; 2 and 3-dihydroxy-2-methylpropyl (meta) acrylate, 2, 3-dihydroxy propyl (Meta) dihydroxy alkyl (meta) acrylate [, such as acrylate, ]; -- hydroxy aryl (meta) acrylate [, such as 2-dihydroxy-3-(meth)acryloyloxy naphthalene, ]; -- diethylene-glycol monochrome (meta) acrylate -- Triethylene-glycol monochrome (meta) acrylate, Propylene-glycol monochrome Hydroxy, such as acrylate (Meta) Alkylene glycol monochrome (Poly) (Meta) acrylate; -- glycerol (poly) monochrome (meta) acrylate [, such as JIGURISE roll monochrome (meta) acrylate, ]; -- alkoxy (poly) glycerol monochrome (meta) acrylate, such as 2-ethyl HEKISOKISHI glycerol monochrome (meta) acrylate, -- Aryloxy (poly) glycerol monochrome (meta) acrylate, such as phenoxy glycerol monochrome (meta) acrylate; : Formula



The hydroxyl-group content (meta) acrylate represented with the monomer shown by (the inside of a formula and R7 are a hydrogen atom or a methyl group), unsaturated carboxylic acids, such as an acrylic acid (meta), etc. are raised.

In order for the monomer which has the hydroxyl group by which it was silanized other than the monomer which protected the hydroxyl group with the hydrophobic silyl machine with the aforementioned mold front face and compatibility to raise the surface hydrophilic property (water wettability) of the lens for eyes after carrying out \*\* silanizing (hydrolysis) of the copolymer moldings and to maintain underwater transparency. Although added, when this monomer is added, the mechanical (dynamic) intensity of the lens for eyes can be raised further. In the solvent used when dealing in the monomer which protected the hydroxyl group for the aforementioned hydroxyl-group content hydrophilic-property monomer with the aforementioned hydrophobic silyl machine, this monomer is obtained by making it react with trialkylsilyl halogenides, such as a trimethylchlorosilane.

In addition, silanizing of the hydroxyl group in a hydroxyl-group content water monomer advances as the following reaction formula (VI).



(or [ the inside of a formula, and / that R is the same as either of the above R4-R6 ] -- or it is a methyl group) .

The monomer which has the hydroxyl group which silanized may be a monomer which protected the hydroxyl group with the hydrophobic silyl machine with all that hydrophobic mold front face and compatibility, and may use together the aforementioned mold front face, the monomer which protected the hydroxyl group with the affinitive hydrophobic silyl machine, and the monomer which has the hydroxyl group which others silanized. However, when using together, it is good to use preferably the monomer which protected the hydroxyl group with the hydrophobic silyl machine with a mold front face and compatibility at a rate of 20 - 70 weight section more than 10 weight sections to all the monomer 100 weight sections that have the hydroxyl group which silanized. When there are few operating rates of the monomer which protected the hydroxyl group with the hydrophobic silyl machine with a mold front face and compatibility than 10 weight sections, the polyorganosiloxane which presents a hydrophobic property strong against the place which touches the mold which has a hydrophobic front face made of synthetic resin gathers mostly, and even if it carries out \*\* silanizing (hydrolysis), the lens for eyes which has a hydrophilic front face is no longer obtained.

the operating rate (monomer which has the polyorganosiloxane which has a polymerization nature machine / hydroxyl group which silanized) of the monomer which has the polyorganosiloxane which has the aforementioned polymerization nature machine, and the hydroxyl group which silanized -- a weight ratio -- 50 / 50 - 95/5 -- 70 / 30 - 90/10 are preferably suitable. If the operating rate of the polyorganosiloxane which has the aforementioned polymerization nature machine becomes less than 50 weight sections. While the lens for eyes which fully has oxygen permeability or flexibility is no longer obtained, when non-water nature or low water nature will no longer be maintained and it will have water nature equivalent to the usual lens for water \*\*\*\* (for example, polymer which consists of hydroxyethyl methacrylate as a principal component), you have to come to give disinfection by boiling etc. if needed. Moreover, if the operating rate of the polyorganosiloxane which has the aforementioned polymerization nature machine increases more than 95 weight sections, the operating rate of the monomer which has the hydroxyl group which silanized in phase-splitting pair will decrease, and the lens for eyes with which a front face presents a hydrophilic property as a result will become is hard to be obtained.

In addition to the monomer which has the polyorganosiloxane which has a polymerization nature machine, and the water acidity which silanized. The need is accepted. For example, styrene, and an alpha methyl styrene, t-butyl styrene, The hydrophobic monomer which has a ring like alkyl styrene, such as isopropyl styrene, or benzyl methacrylate, Methyl (meta) acrylate, ethyl (meta) acrylate, propyl (meta) acrylate, Even if butyl (meta) acrylate, hexyl (meta) acrylate, 2-ethylhexyl (meta) acrylate, truffle RUORO ethyl (meta) acrylate, dodecyl (meta) acrylate, etc. are replaced. Good alkyl (meta) acrylate; you may add alkyl crotonate;N, such as alkyl itaconate; propyl crotonate, such as alkoxy (poly) alkylene glycol (meta) acrylate; dimethyl itaconate, such as methoxy diethylene-glycol (meta) acrylate and ethoxy-tripropylene-glycol-(meta)-acrylate, and diethyl-itaconate, N-dimethyl-(meta)-acrylamide, N-vinylpyrrolidone, etc.

The amount used to all the monomer component 100 weight sections of the above and other monomers is 0 - 25 weight section, and it is desirable to carry out 5 weight sections content at least from the field of raising intensity.

When the monomer which has the hydroxyl group which especially silanized when it is used in addition to the monomer which has the polyorganosiloxane (A) which has the aforementioned polymerization nature for the hydrophobic monomer which has a ring among these monomers, and the hydroxyl group which silanized, and the hydrophobic monomer which has a ring are used together, the intensity of material can be raised by leaps and bounds according to the synergistic effect.

Moreover, when using the hydrophobic monomer which has especially a ring, in order to fully demonstrate the effect of this monomer, as for the operating rate (filtered-water nature monomer which has the monomer/ring which has the hydroxyl group which silanized) of the monomer which silanized, and the hydrophobic monomer which has a ring, it is desirable that it is in the range of 1 / 1 - 3/1 by the weight ratio.

The polymerization fabrication method of the monomer constituent which consists of the above and other monomers by the monomer and request which have the polyorganosiloxane which has the aforementioned polymerization nature machine, and the hydroxyl group which silanized is performed by the usual mould method. That is, it carries out whether the aforementioned monomer constituent is mixed, a polymerization initiator is added to this, the combination liquid which it comes to mix uniformly is calmly poured into it into a concave, a concave convex type is carried, and it inserts by the clamp etc., or a weight is carried on mold, a concave and a convex type are bound tight moderately, and if this mold is put into the suitable container for polymerizations, and is heated or an electromagnetic wave is irradiated, the polymerization of the combination liquid is. When heating, that what is necessary is to heat for several hours to dozens hours, and just to carry out a polymerization at about 40-90 degrees C (there is a possibility that the mold made of synthetic resin may deform when temperature is higher than about 90 degrees C), if needed, a temperature up may be carried out gradually and a polymerization may be carried out. In order to complete a polymerization good, a deoxidant may be put in in the aforementioned container for polymerizations, and a polymerization may be carried out and carried out to reduced pressure. Mold is cooled after polymerization completion, a concave and a convex type are

separated, and the copolymer moldings fabricated in the shape of a lens from mold is exfoliated. In this case, you may remove a copolymer moldings from casting in the solvent which does not have a bad influence on copolymer moldingses, such as alcohol and an acetone, if needed.

Although the mold which has a hydrophobic front face made of synthetic resin is used as the aforementioned mold, although polypropylene, polyethylene, polystyrene, the Poti vinyl chloride, polytetrafluoroethylene, poly 3 fluoride-salt-ized ethylene, etc. are raised, for example, as the quality of the material, polypropylene is desirable also in these. It is easy to carry out injection molding of the hydrophobic mold produced from synthetic resin, such as the aforementioned polypropylene, to a mold configuration, and it can produce mold which gives a front face with a sufficient precision required of the lens for eyes with a sufficient precision, has the various advantages of moreover being easy to receive, and is very useful as mold for lenses for eyes. This mold has a forming side of specification (radius of curvature, a diameter, thickness, etc.) where the lens for eyes which the inside makes the purpose is obtained, and is produced by injection molding etc. by making a concave and a convex type into a lot.

Next, \*\* silanizing is given to the copolymer moldings obtained in this way.

\*\* silanizing (hydrolysis processing) is performed by heating the obtained copolymer moldings in alcoholic usual solution. Extraction removal of the unnecessary resultant which furthermore heated the lens for eyes in alcoholic solution etc. using the extractor, and was generated by the unreacted object and \*\* silanizing in polymerization reaction is carried out. By desorbing a silyl machine and making a hydroxyl group generate by this processing, the surface hydrophilic property (water wettability) stabilized for a long period of time can be given to the lens for eyes.

As alcohol used for a \*\* silanizing reaction, a methanol, ethanol, propanol, etc. are raised and an isopropanol with the nearest property etc. is especially desirable to a non-polar solvent. The reason the alcoholic aforementioned solution is alcohol which contains water about 1 to 40%, and alcoholic solution is used, Alcoholic solution has a hydrophobic polyorganosiloxane, a hydrophobic silyl machine, and good compatibility, and is because \*\* silanizing can be efficiently advanced in a copolymer moldings and extraction removal of the unreacted object of an important reaction or the unnecessary product by \*\* silanizing can be easily performed, since some copolymer moldingses are moreover made to swell.

Subsequently, it is made to once dry and the obtained lens for eyes is saved by being immersed into solution, such as a physiological saline, after that, in order to remove the solvent used for extraction processing.

Although the manufacture method of the lens for eyes of this invention is further explained to a detail based on an example below, this invention is not limited only to this example. (Composition of the monomer which protected the hydroxyl group with the hydrophobic silyl machine with a mold front face and compatibility)

Synthetic example 1 2-hydroxyethyl methacrylate 33g, triethylamine 25g, and acetone 500ml were \*\*\*\* (ed) to the Erlenmeyer flask. While ice cools a flask, it continues agitating, what dissolved t-butyldimethyl chlorosilicane 38g in acetone 50ml is dropped there, and the reaction was advanced for about 3 hours, keeping at 10 degrees C or less.